suitable on account of the fact that they attained a fair size before any sign of anthocyan formation became observable. Buds of these were gathered of the largest size attainable before any sign of anthocyan formation had appeared. The young petals were well crushed in warm alcohol (*circa* 95 per cent.), and, after standing for a short time, the extract was filtered, and the filtrate acidified by the addition of a small amount of concentrated hydrochloric acid. When the acid was added, the filtrate changed slightly from pale yellow to colourless (on the other hand, ammonia gave a deeper yellow), but in neither case was any red tint due to anthocyan observed. The acidified filtrate was divided into two portions; to one a little magnesium was added, the second was retained as a check. In the case of both rose and viola, a gradual change to a clear pale red took place in the colour of the liquid to which the magnesium had been added. The portion of the acidified extract which had not had magnesium added to it remained colourless. These observations leave no doubt that, in the cases examined, there were flavonol derivatives present in the buds which would later have developed anthocyan colours, but in which up to that time no anthocyan had been formed.

The authors intend to extend these observations.

A Remarkable Flint Implement from Selsey Bill.

By Sir Ray Lankester, K.C.B., F.R.S.

(Received January 18, 1921.)

[Plates 8–11.]

It is desirable that the large rostrate flint implement drawn in figs. 1, 2, and 3, and the hammer-stones drawn in figs. 4 and 5 should be made known without further delay to students of prehistoric archæology. These specimens were placed at my disposal in 1912 by Mr. Edward Heron Allen, F.R.S., and have now been presented to the Department of Ethnology and Mediæval Antiquities of the British Museum. They were briefly mentioned by me in a postscript to my paper on "The Discovery of a novel type of Flint Implements below the base of the Red Crag of Suffolk."*

These specimens were (as I am informed by Mr. Heron Allen) found in November, 1911, when the shingle was suddenly washed away below the alluvial cliffs and Raised Beach on the west shore of Selsey Bill, exposing a band of yellow clay, about 100 yards long and 4 yards in breadth. Lying on this were large flints, and the first which attracted Mr. Heron Allen's attention were those described and figured in this communication. Besides these he collected a barrowful of large broken flints, which he later submitted to my examination. The shape of many was suggestive of preliminary trimming, with a view to chipping as "pointed" implements, but the big rostrate implement and the two hammer-stones here figured, which were in the first instance secured by Mr. Heron Allen, were the only flints among the lot which had been obviously and certainly shaped by man. Subsequently many other large fractured flints—some of two or three pounds in weight—were found accumulated in patches on the sand at low tide, 200 yards further in a south-westerly direction. Though the shape of many of these (which were collected by visitors to the spot) was suggestive, none were discovered the fracturing of which could, at that time, be decisively attributed to human agency. After examining some hundred or more selected by Mr. Heron Allen and other observers, I came to that conclusion. It is, however, of course to be expected that other humanly-worked flints besides the three specimens now described and figured will eventually come to light at this spot.*

---

* 'Phil. Trans.,' B, vol. 202, p. 332.

The clay on which the flints collected by Mr. Heron Allen were resting is of Bracklesham age. It is overlaid in the low cliff exposed at Selsey by a light-coloured gravel, which has been described by the late Mr. Clement Reid as Coombe rock.

The large "worked" flint, the position and finding of which are described above, is represented in figs. 1, 2, and 3. It weighs 5 lb. 12 oz., and is 8 inches long and 5½ inches broad. It has been shaped by numerous—mostly large and coarse—fractures to the form of a rostro-carinate implement, having a well-marked tapering "rostrum" (fig. 1) and a relatively flat ventral area (fig. 2), corresponding to the ventral plane of a typical "rostro-carinate." But there is no "carina"; that is to say, the essential shaping has not been attained by the removal of large flakes of flint right and left of the mid-dorsal line, so as to leave a median *arête* or carina. On the contrary, the shaping of the rostral region has been attained by the removal of one very large flake on the left side (fig. 1, *A*) and by a series of four parallel ribbon-like fractures of the upper surface (fig. 1, *1*, *2*, and fig. 2, *2*, *3*, *4*). Adjoining these on the right side, is the scar (fig. 2, 5) of a broader fifth flake, truncated by a sixth (see fig. 2, *6*).

---

* [*Note added March* 8, 1921.—Some of the large angular flints from Selsey would re-pay further examination. Mr. Edward Heron Allen has recently sent me one which, I agree with him, must be admitted as bearing conclusive evidence of flaking by human agency.]

The rest of the entire surface of the specimen has been trimmed by very numerous blows, some of great power. These have removed all of the original cortex of the flint nodule operated upon, excepting a few small patches, marked *cort.* in figs. 1, 2, and 3. The trimming fractures of the general surface have produced a few "rippled-marked" scars (fig. 2, *R*, *S*, *T*, *V*, *X*). For the most part, the surface presents a series of irregular convexities and concavities of a silky black appearance.

The specimen is not iron-stained, and is entirely free from water-wear or water-polish—though the fracture-edges are not sharp, but feel smooth and blunted when the finger is passed over them.

I have already mentioned the existence of a few small patches of the original "cortex" or "bark" of the nodule. There is here and there—on the ventral surface—(for instance, in the region about S in fig. 2)—a superficial change of the black colour of the fractured flint surface to grey. This decomposition of black flint usually, but not always, takes place on a broken surface—commencing as a pale bluish "bloom." It becomes whiter and more opaque, with longer duration of exposure. It is convenient to call this change "lactescence," as I have proposed in 'Proc. Roy. Soc.,' 1920.

Lactescence is seen commencing as a very slight "blueing" of the fractured surface in large blocks of flint at Brandon—which have been broken and exposed in the knappers' yards for as short a time as six months. On the other hand, fractured flints are common enough with black surface showing no trace of lactescence, although fractured many thousands of years ago. The conditions which favour and those which prevent this change of surface have never been ascertained.

I propose to call this implement the "Selsey rostrate." If others of the same form should hereafter be found at Selsey, they may be named Selsey rostrate B, C, D, and so on.

The Selsey rostrate was not manufactured from a "blank" trimmed to a tabular shape nor from a block of natural tabular flint. It is very usual for palæolithic implements of smaller size than this to have been flaked into shape from a piece of flint measuring about 5 inches in length, 3 inches in breadth, and 2 inches in thickness. The tabular form was either produced by the preliminary "roughing out" of a nodule or, more rarely, owed its initial shape to the fact that the piece selected for use was a block of *natural* tabular flint.

The Selsey rostrate is an unusually big and heavy implement, and was chipped out of a big heavy nodule, measuring probably not less than 9 inches in length, 6 inches in breadth, and 4 inches in thickness. It is too heavy for use, as a pick or axe, in one hand, and is not shaped for being held by both hands. The inference from its great size, and from the powerful blows which have been used, with skilful precision, in its manufacture, is that it was made and used by a man of larger hand and limb than are possessed by any modern race. It would be a mistake to attach much importance to this suggestion, since we are singularly devoid of any well-founded opinions as to the way in which the larger palæolithic flint implements known to us were brought into effective use, and the purpose or purposes for which they were used.

In regard to flint implements of the largest size, it is to be noted that we know of rare specimens of tongue-shaped or pick-like implements from river-terrace gravels of Acheulæan and Chellæan age, as much as 11½ inches in length and 5 lb. in weight. Such a specimen is in the Department of Ethnology of the British Museum, another in the National Museum of Antiquities of St. Germain, and one in the collection of Mr. Scott, of Bournemouth. Possibly these unusually large implements were not for ordinary use, but were ceremonial emblems of authority.* Very large neolithic adzes ("celts") of stone (not flint) are found in the north of Scotland and Ireland. One as much as 10 inches in length, and weighing 5 lb. 4 oz., is in the Sturge collection at the British Museum. Undoubtedly, these were mounted on wooden handles, in a fashion similar to that employed by modern stone-weaponed races for similar large adzes of polished stone. The palæolithic flint implements from our river-terrace gravels—of the more frequent size and shape—namely, ovate, 4½ inches long and 3 inches broad, weighing ¾ lb.—and tongue-shaped specimens—often 9 inches long and 4 inches broad at the butt, weighing 1¾ lb.—are carefully shaped and well balanced for use in the hand. They could be readily used either with or without a "mount" or handle.

The question as to the mode of use of certain exceptionally large and heavy flint implements comparable to the Selsey rostrate, has a separate importance. I know of two only which are comparable in weight and size to the Selsey specimen, and these are from very ancient deposits held to be much anterior (in geological time) to the terrace gravels of our river valleys. The first of these is the large more or less cylindrical flint, flaked at one end to a cutting edge, which was discovered by Mr. Reid Moir, in 1909, in the Sub-crag detritus bed in Bolton and Laughlin's large clay pit at Whitton, Ipswich, and figured by me.* This flint is 10¼ inches in length and weighs 8 lb. 12 oz. It is too heavy for use in one hand but might well have been held by both hands and used for "pounding."

---

* [*Note added March* 8, 1921.—A very large oval flint implement from the gravel at Taplow has recently been presented to the Natural History Museum by Mr. Treacher. It is of superior workmanship, perfectly symmetrical and clearly flaked. It weighs 6 lbs. 2 ozs., and is 12⅛ inches long. Apparently it is of Acheulæan age and is, I believe, the largest and most skilfully worked implement known from that horizon. It was probably a "ceremonial" emblem of authority and not intended for ordinary use.]

The second is the most remarkable among a great number of very large worked flints, recently discovered by Mr. Reid Moir below the forest-bed at Cromer in such a position as to indicate a workshop or flint-workers' "floor"—of an age anterior to that of our river-terrace gravels. Mr. Moir will have given a preliminary account of his discovery before the present communication is published. The largest of the worked flints from this newly-discovered "floor" weighs 7 lb. 6 oz., is 10 inches in length, 5½ inches broad and at the "butt" end is 4 inches thick. It has a rostrate form, a relatively flattened ventral surface and is richly worked all over by large coarse flaking of indubitable human origin. It presents a marked resemblance—both in general form and in the character of the flaking of its surface—to the Selsey rostrate as well as in its great size and weight.

The point to which I wish to draw attention in regard to these three unusually large and heavy flint implements, is that they belong to a very early period, antecedent to that of the familiar tongue-shaped and ovate implements of Chellæan and Acheulæan age. This is certainly true of both Mr. Reid Moir's big implements, and is probably true of the Selsey rostrate.

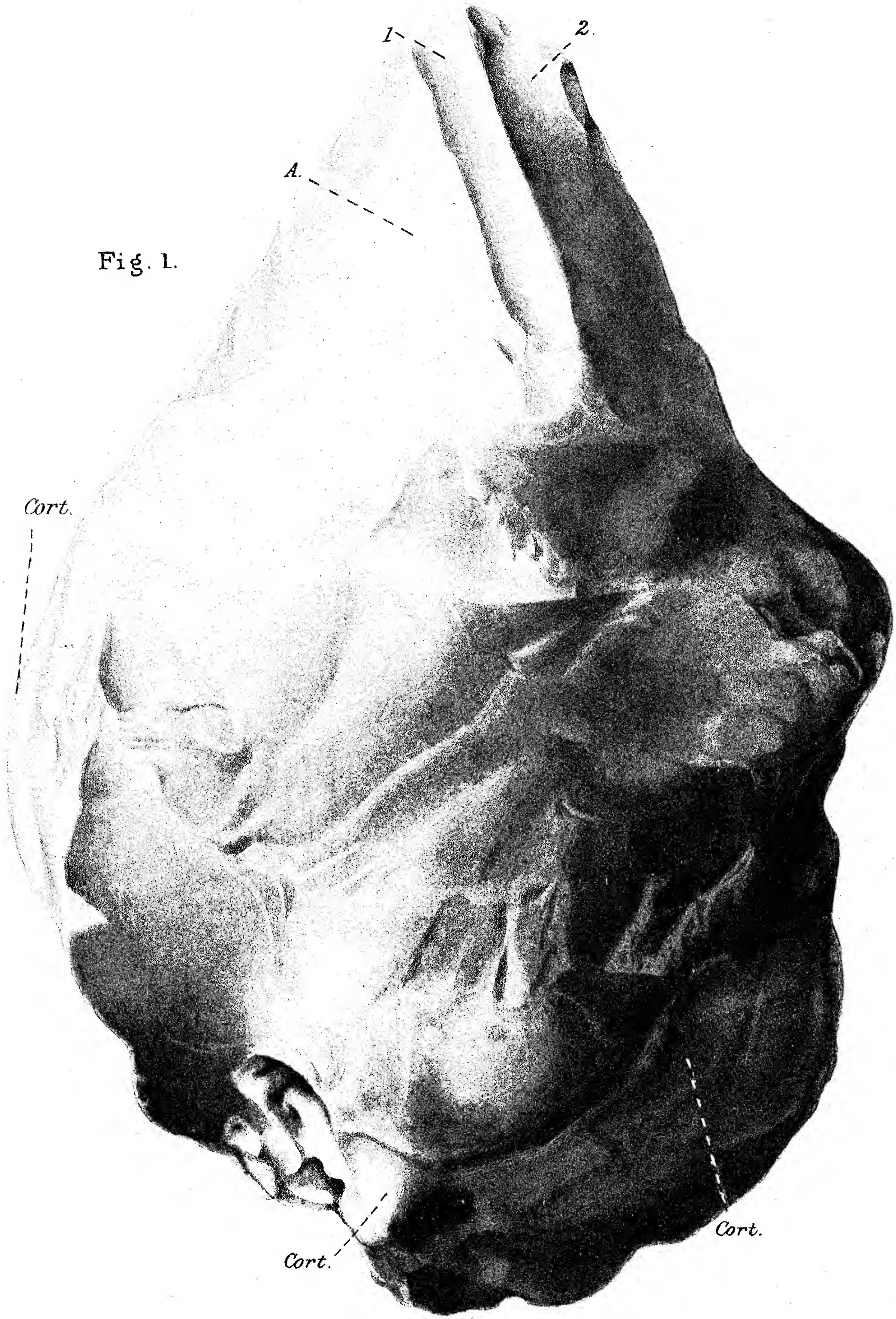
The early age of these big implements is consistent with the hypothesis that they were made and used by an early race of men of heavier build than that which succeeded them and produced the abundant ovates and tongue-shaped implements of our terrace gravels.

Whether made by an exceptionally big race or by men of the modern size, the use of heavy big flint implements, such as the three which I have here cited, presents a problem. If used merely as hammers or as club-heads they would be unwieldy and would not require any special shaping—such as would give precision to a smaller implement. The only suggestion I can offer as to their use besides that of "pounding" or breaking into the cavities of the bones of large animals in order to extract marrow, brain, etc.—is that they were employed either affixed to a handle or held by the two hands for the purpose of breaking a hole in the ice on the surface of a lake or marsh pool. Fish come to such openings in the ice and are then readily speared or captured.

---

* 'Phil. Trans.,' B, vol. 202, pp. 323, 324 (1912).

Fig. 1.



G.M. Woodward del.

Huth coll.

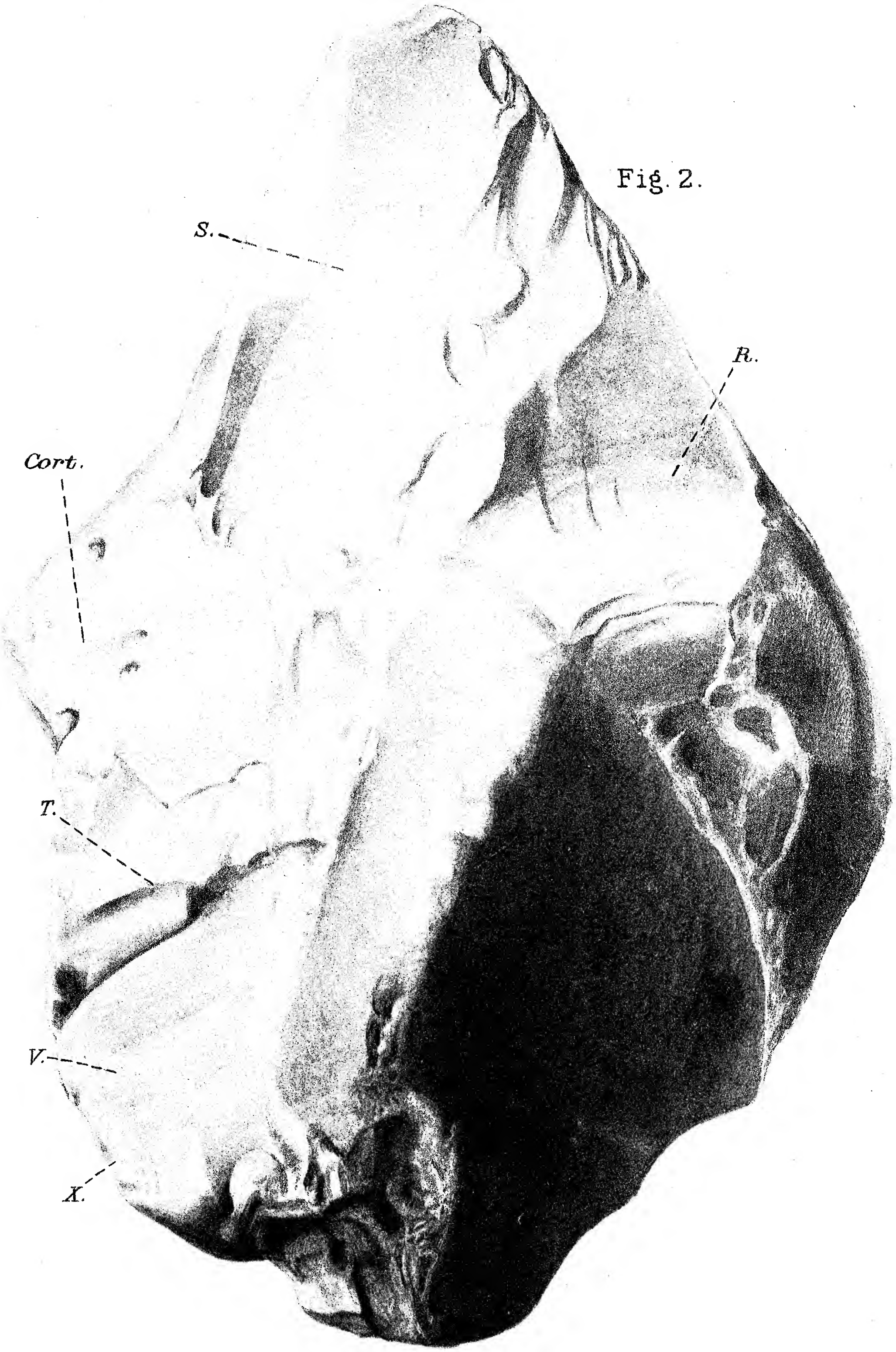


Fig. 2.

G.M. Woodward del. Huth coll.

Huth coll.

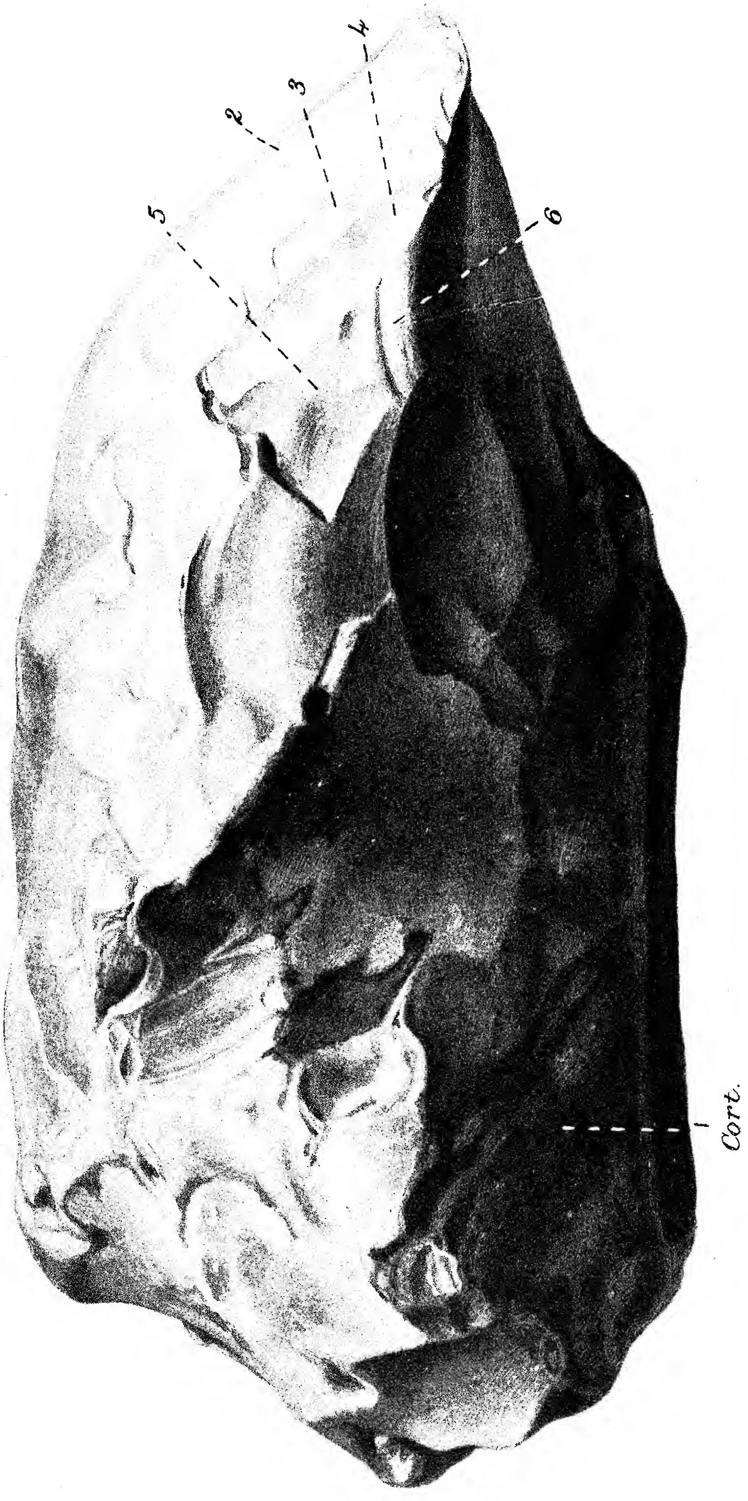


Fig. 3.

G.M. Woodward del.

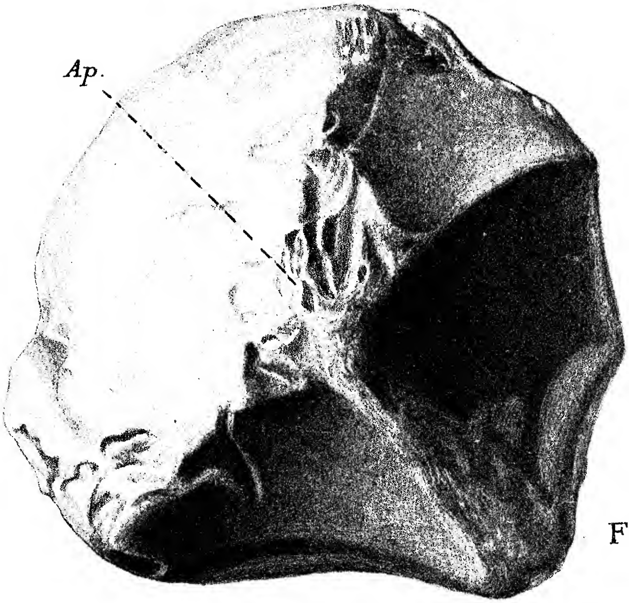


Fig. 5.

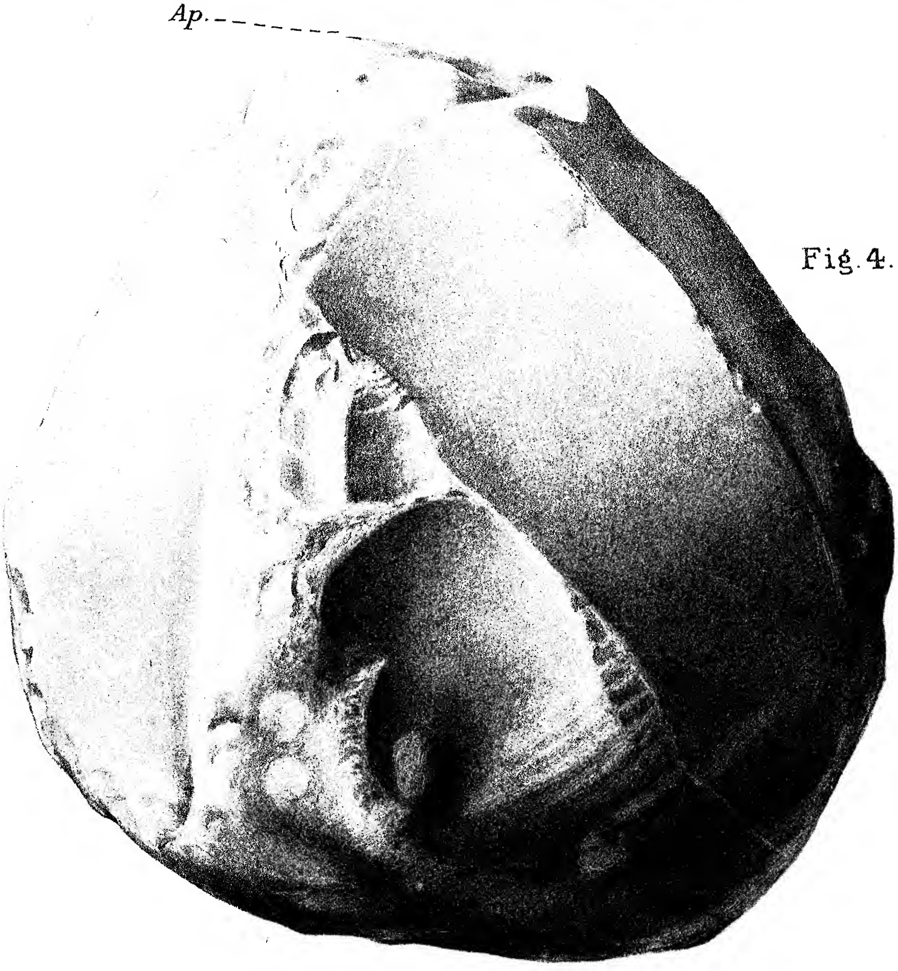


Fig. 4.

G. M. Woodward del. Huth coll.

In figs. 4 and 5 careful drawings are given of two hammer-stones—a larger and a smaller—found in association with the Selsey rostrate and presenting the same colouring and mineral condition of the flint which characterise that implement. They have been flaked so as to furnish a prominent apex which shows evidence of its use as the striking surface in the fact that it is more or less comminuted. The smaller of the two hammer-stones is flaked so as to form a four-sided pyramid and is similar in this respect to the four-sided pyramidal hammer-stone from the Sub-crag detritus or nodule bed figured in my paper, 'Phil. Trans.,' B, vol. 202, p. 313. It is a fact of distinct importance tending to associate the specimens from Selsey Bill with those of the Sub-crag deposit of Suffolk, that a four-sided pyramidal hammer-stone is among the implements discovered in both localities.

EXPLANATION OF PLATES 8 TO 11.

(Reproduced from water-colour wash-drawings made by Miss Gertrude Woodward.)

PLATE 8.

FIG. 1.—The large Selsey rostrate flint implement ; dorsal surface. Drawn of the actual size of the specimen.

A. Scar of very large conchoidal flake removed from the left side of the rostral region.

1 and *2*. Scars of parallel ribbon-like flakes removed from the region to the right of *A*.

Cort. Portions of the original cortex of the nodule.

PLATE 9.

FIG. 2.—The large Selsey rostrate ; ventral surface. Drawn of the actual size of the specimen.

Cort. Small area of cortex or original "bark" of the nodule.

R, *S*, *T*, *V*, *X*, point to "conchoidal ripplings" of the fractured surface, each letter pointing to the conchoidal fracture produced by a separate blow : some heavy, some light.

PLATE 10.

FIG. 3.—The large Selsey rostrate, right lateral surface. Drawn of the actual size of the specimen.

Cort. An area of cortex or original bark of the nodule (see fig. 1, right side, for the same area).

2, *3*, *4*. Scars whence ribbon-like flakes have been struck, the scar 2 is seen in the view of the dorsal surface given in fig. 1 ; scars 3 and 4 are noticeable for the conchoidal transverse rippling of the flint.

5 is the scar of a broader flake parallel to *2*, *3*, *4*, which is truncated by the well-marked conchoidal scar, *6*, of another shaping-flake.

PLATE 11.

FIG. 4 and 5.—The two hammer-stones found in association with the Selsey rostrate. Drawn of the actual size of the specimens. That shown in the upper figure (fig. 5) is less than half the bulk of the other. It is of pyramidal form, and is drawn so as to show the apex of the pyramid as the centre of the picture, with three large concave flake scars and a fourth convex area, radiating from it. The apex shows numerous small fractures due to its use as the striking surface. The larger hammer-stone drawn in the lower figure (fig. 6) has also been shaped by large flakes to a pyramidal form. In this drawing the apex forms the top of the figure, the stone resting on the opposite surface or base.

Reversal of Asymmetry in the Plutei of Echinus miliaris.

By HIROSHI OHSHIMA, Kyushiu Imperial University, Fukuoka, Japan.

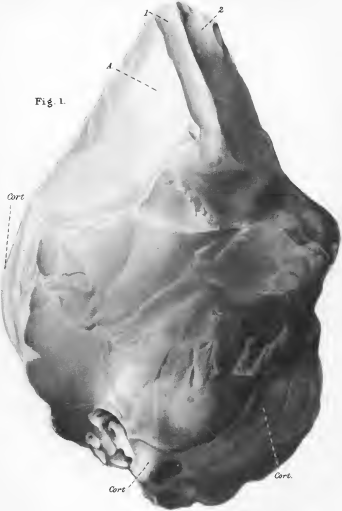
(Communicated by Prof. E. W. MacBride, F.R.S. Received February 15, 1921.)

While engaged in artificial rearing of *Echinus miliaris* under the guidance of Prof. MacBride,* I have come across a number of abnormal plutei which had the hydrocœle developed on the right side instead of in its normal position on the left side. Such reversed larvæ were first found on May 31, 1920, when they were eleven days old (text-fig. 1). The "larval" body was quite normal both in size and shape, but the hydrocœle, stone-canal, axial sinus, madreporic vesicle, and amniotic invagination were all situated on the right side, so that the larva became a perfect mirror-image of the normal larva. Such larvæ developed further with exactly the same rate of growth as the normal ones, an echinus-rudiment being well developed on the right side, until at last, when a month old, some few of them passed metamorphosis. The young urchins (text-fig. 2) showed no features visible externally which differed from those of urchins metamorphosed from normal larvæ. A similar case has previously been described only by Runnström in two individuals found among artificially reared larvæ of *Strongylocentrotus lividus* ((9), pp. 2–3, 7–10; (12), pp. 419–24, Plate 14, figs. 12–16). In other classes of Echinoderms, auriculariæ with the hydrocœle on the right side were noticed by Müller many years ago ((7), pp. 101, 109; Plate 5, fig. 1), and a similar state of affairs in two plutei of *Ophionotus hexactis* has recently been discovered by

---

* It is my pleasant duty here to express my extreme indebtedness to Prof. E. W. MacBride for his kind supervision on the present work, and to Sir Sidney F. Harmer for permission to use the British Museum (Natural History) Library. A more detailed account of this work will be published elsewhere before long.

Fig. 1.



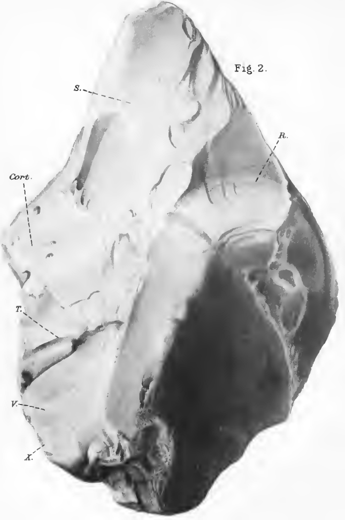


Fig. 2.

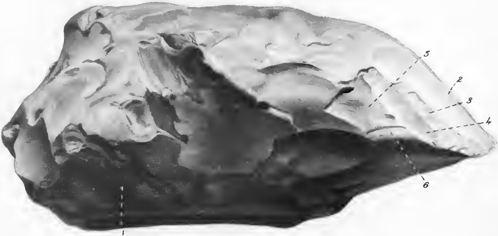


Fig 3.

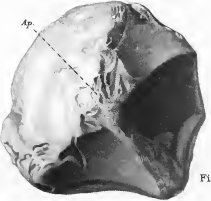


Fig. 5.

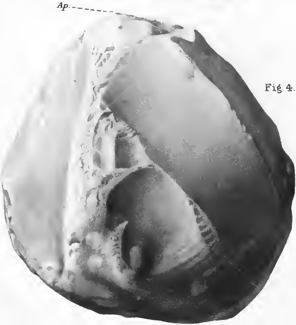


Fig 4.